SUBSTITUTE FORM PTO-1390 U.S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 12758-003001

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If Known, see 37 CFR 1.5)

09/744881

INTERNATIONAL APPLICATION NO. PCT/DE99/02410	INTERNATIONAL FILING DATE 2 August 1999	PRIORITY DATE CLAIMED 6 August 1998

TITLE OF INVENTION
METHOD AND DEVICE FOR ALLOCATING CHANNELS IN A COMMMUNICATION SYSTEM WITH CDMA SUBSCRIBER SEPARATION

APPLICANT(S) FOR DO/EO/US
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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).

4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).

7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.

8. ☐ An English language translation of amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern other documents or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. ☐ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☐ Other items or information:
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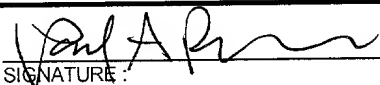
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U.S. APPLICATION NO. (IF KNOWN) 09/744893	INTERNATIONAL APPLICATION NO. PCT/DE99/02410	ATTORNEY'S DOCKET NUMBER 12758-003001

17. ☒ The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)- (5)):

Neither international preliminary examination fee (37 CFR 1.482)
nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO
and International Search Report not prepared by the EPO or JPO............. $1000

International preliminary examination fee (37 CFR 1.482) not paid to
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International preliminary examination fee (37 CFR 1.482) not paid to USPTO but
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International preliminary examination fee paid to USPTO (37 CFR 1.482)
but all claims did not satisfy provisions of PCT Article 33(1)-(4)................... $690

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Claims	Number Filed	Number Extra	Rate		
Total Claims	1 - 20 =	0	x $18	$18	
Independent Claims	1 - 3 =	0	x $80	$80	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ $270		
TOTAL OF ABOVE CALCULATIONS =				$958	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				$0.00	
SUBTOTAL =				$958	
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Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31).**$40.00** per property +				$0.00	
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NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO·

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REGISTRATION NUMBER

20199435 doc

09/744881

APPLICATION

FOR

UNITED STATES LETTERS PATENT

TITLE: ALLOCATING CHANNELS IN A COMMUNICATIONS
             SYSTEM

APPLICANT: MARKUS DILLINGER

6/PRTS

09/744,511

ALLOCATING CHANNELS IN A COMMUNICATIONS SYSTEM

Claim To Priority

This application claims priority from German

5   Application No. 19835643.9 and Patent Cooperation Treaty

(PCT) Application No. PCT/DE99/02410.

Background

The invention relates to allocating channels in a

10   communications system with (Code Division Multiple Access)

CDMA subscriber separation.

In a communications system, a channel is a link from

a message source (transmitter) to a message sink

(receiver). The information to be transmitted is usually

15   encoded, modulated and amplified at the transmitter.

After transmission, which generally includes attenuation

and distortion, the information is evaluated at the

receiver using measurements that correspond to the

transmitter.

20

Summary

In general, in one aspect, the invention is directed

to allocating channels in a communications system in which

code division multiple access (CDMA) codes are used to

25   define channels between a transmitter and a receiver.

This aspect includes deriving a new CDMA code for a channel from other CDMA codes for other channels. The new CDMA code is derived based a tree structure that contains symbols that define the new CDMA code.

5   Other features and advantages of the invention will become apparent from the following description, including the claims and drawings.

Description of the Drawings

10   Fig. 1 shows a structure of orthogonal CDMA codes with a variable spread factor.

Fig. 2 shows a tree structure representing the CDMA codes.

Figs. 3 to 5 show allocation strategies for the

15   allocation of channels.

Fig. 6 shows a schematic representation of a mobile radio system.

Description

20   Referring to Fig. 6, a radio communications system 10 is shown. In that system, information, such as voice, images and other data, is transmitted using electromagnetic waves. The information is transmitted over a radio frequency (RF) interface between transmitting

25   and receiving radio stations (e.g.., a base station (BS) 12 and mobile stations (MS) 14, respectively). The

electromagnetic waves are emitted using carrier

frequencies that lie in a frequency band provided for the

communications system. Other frequencies, such as

frequencies in the 2000 MHz frequency band (or

5   thereabouts) are provided for future mobile radio systems

with CDMA or time-divisioned (TD) CDMA transmission. An

example of such a system is the UMTS (Universal Mobile

Telecommunication System..

FDMA (frequency division multiple access), TDMA (time

10   division multiple access), and/or CDMA (code division

multiple access) subscriber separation are used to

discriminate between signal sources (MS or BS), and thus

to evaluate the signals. In CDMA subscriber separation,

which is the subject of the process described herein,

15   channels are distinguished using individual CDMA codes.

Channel allocation is a strategy for allocating

frequency channels to individual links 16 so as to make

best possible use of radio resources. In channel

allocation, care is taken to ensure that resource (e.g.,

20   bandwidth) allocation to existing channels is as small as

possible in order to accommodate future data rates. A

resource expenditure arises if a CDMA code has to be

removed from an existing link and a different CDMA code

has to be allocated to the link.

25   In the process for allocating channels described

herein, CDMA codes define channels for RF links. The CDMA

codes that are available for allocation to channels are derived from one another using a tree structure (see, e.g., Fig. 2, described below). The CDMA codes are represented by nodes within the tree structure. In the

5　tree structure, a chip sequence (e.g., 1110) of a higher order CDMA code is a subset of a chip sequence of a lower order CDMA code. In one node, a plurality of branches converge and, in turn, lead to further lower order nodes.

　　The nodes in the channel allocation process use

10　sequences of symbols for the chip sequence, in this embodiment, ones and zeros. The sequences of symbols for two nodes differ at a position that corresponds to the distance between the two nodes and their joining node within the tree structure. A small difference in position

15　means that two nodes differ significantly. This is true when the difference occurs near to the root of the tree structure. In other words, the joining node (parent node) is near to the root of the tree in this case.

　　Free nodes (i.e., unassigned nodes) and assigned

20　nodes are distinguished. A free node designates a non-assigned (i.e., free) CDMA code and an assigned node designates an assigned CDMA code. Only non-assigned CDMA codes can be allocated to an RF link/channel.

　　To allocate a free CDMA code to a link, free nodes

25　are selected, which are not connected to an already-occupied node directly in an upward or downward direction

5

in the tree structure. In this embodiment, free nodes

that differ from an already occupied node by at least one

symbol are selected. It is noted that it is not

permissible to allocate a CDMA code whose chip sequence is

5   a precise subset of a CDMA code that has already been

assigned or whose chip sequence forms a subset of a

previously-assigned chip sequence.

The position in the sequence of symbols at which a

difference from an already occupied node occurs is

10   determined for selected nodes starting, in each case, at

the root of the tree structure. The position is a measure

of the discriminating (i.e., differentiating) "power" of

the two CDMA codes. This power is the ability of the

codes to differentiate channels. If two CDMA codes differ

15   significantly, the data rate in two channels can be

increased for one of the CDMA codes without risking a

collision with the second CDMA code.

In the subject allocation strategy/process, a sum of

positions of nodes in the tree structure is determined for

20   all of the assigned nodes. A channel with the CDMA code

that corresponds to the node having a predefined sum is

allocated. The allocation strategy is thus related to the

discriminating power with respect to all the other CDMA

codes, i.e., to a sum of instances of discrimination.

25   The tree structure is such that the distance between

a node and a root node corresponds to an increase in a

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spread factor of the CDMA code, and thus directly to a
reduction in the data rate for the link defined by that
code. The data rate can be increased without allocating
other CDMA codes by changing a CDMA code. This is done by

5   removing an existing node and allocating a new node to the
tree structure. The new node branches off from the
existing node in the direction of the root.

One advantage of the foregoing allocation
strategy/process is that the predefined sum may be

10   relatively small. This ensures that the CDMA codes differ
greatly. This, in turn, leaves open the possibility that
the data rate for the link with the newly-allocated CDMA
code can be increased in the future without significantly
affecting the rest of the allocation process.

15   The objective is different if no increase, or only a
limited increase, in the data rate is possible or desired
for a large number of connections. This is the case,
e.g., for subscribers with a fixed basic data rate. Here,
it is usually better if the predefined sum is maximized.

20   CDMA codes which do not differ greatly are thus assigned.
That is, parts of the tree structure are kept free for
further links with higher data rates.

A mixed form of the previous two processes enables
the data rate of a link to be increased, and a node with a

25   difference from an already assigned node at a specific
position to be selected. The possibility of increasing

the data rate is expressed in the tree structure in a number of nodes that can be displaced in the direction of the root (a node before the joining node with an already occupied node) without a collision occurring with a CDMA

5   code that has already been assigned. If the increase possibility is known in advance, a part of the tree structure that is just sufficient, i.e. not too much and not too little, can be reserved.

The process can also be implemented in multiple

10   stages. Thus, a plurality of channels with different CDMA codes can be allocated. A desired data rate results from the totality of the individual data rates of the CDMA codes. The free nodes of the tree structure can nevertheless be utilized with a high utilization rate,

15   i.e. occupancy of the nodes.

For digital systems that are widespread, the symbols are digital values. From each node, a branch branches off in the direction of the root and two branches branch off in the opposite direction. A mapping of the CDMA codes

20   onto the tree structure includes two following nodes of outgoing branches to be mapped, starting from the root of the tree structure using an additional "0" or "1" in the sequence of symbols.

The CDMA codes are, for example, orthogonal codes

25   with a variable spread factor (Orthogonal Variable Spreading Factor - OVSF). As a result, detection at the

receiver is made easier because such CDMA codes continuously support optimum decorrelation.

Although a channel assignment system according to the invention can be used in a very wide variety of communications systems, use in the downward direction (from MS to BS in Fig. 6) of a radio interface in a broadband radio communications system is particularly advantageous. Such a radio interface is designed for a third mobile radio generation and can support a large number of channels. The more channels, the more important it is to have a good assignment strategy.

A desired data rate and/or increased possibility for a data rate of the link is derived from an identifier and/or from a signaled request of a mobile station (MS). The increased possibility can thus be determined precisely for the mobile stations, in accordance with the current link and service profiles therefor. As a result, only free spaces in the tree structure that are necessary and useful are reserved in the assignment strategy.

An example of a communications system in which the channel assignment process described herein may be use is a digital radio communications system with broadband channels, such as that described in "UTRA Physical Layer Description FDD parts", volume 4 (dated June 25, 1998). In that system, like other systems with CDMA subscriber

separation, different links can be distinguished using an individual CDMA code to spread the signals.

For the downlink direction, i.e., RF transmission

5 from BS 12 to MS 14, the codes of Fig. 1 may be used. These codes are orthogonal codes with a variable spread factor (OVSF) and a fixed chip rate of 4.096 MCPS. The orthogonal codes are represented in the tree structure of Fig. 1 with individual CDMA codes being derived from other CDMA codes in the tree structure.

10 From one level of the tree to another level, the number of chips per CDMA code, and thus the spread factor (SF), doubles. Starting from the CDMA code with the chip sequence (1, 1) two CDMA codes of the next lowest level (1, 1, 1, 1) and (1, 1, -1, -1) are derived. The first

15 half (1, 1) of the upper level code is used for the new, lower-level code and the second half the same (1, 1) or an inverted form (-1, -1) of the upper level code. This produces a code family over, e.g., eight levels.

Within the eight levels, there are 508 different CDMA

20 codes with eight different data rates (2048 Kilobit per second (Kbit/s) with SF = 4, 1024 Kbit/s with SF = 8, 512 Kbit/s with SF = 16, 256 Kbit/s with SF = 32, 128 Kbit/s with SF = 64, 64 Kbit/s with SF = 128, 32 Kbit/s with SF = 256). For example, a 32 Kbit/s gross

25 data rate is needed to encode voice information with an

8 Kbit/s net data rate and to transmit the voice

information via the radio interface with error protection.

Within the level with a spread factor SF = 256, there

are 256 different CDMA codes and, at the next highest

5   level, there are 128 CDMA codes, etc. The CDMA codes are

allocated in accordance with a data rate (i.e., bandwidth)

required by the link/channel. If all the CDMA codes are

still free, e.g., during the run-up phase, one of the CDMA

codes can be allocated at random. However, if some of the

10   CDMA codes have already been assigned, peripheral

conditions have to be taken into account in the allocation

of a free CDMA code to a new link.

The CDMA codes that are used within a frequency band

in a radio cell differ in at least in part of their chip

15   sequence. Furthermore, changes in the data rate of a link

can be permitted in a predictive fashion. CDMA codes of a

higher level should not be blocked by a new allocation of

a lower-level CDMA code.

Thus, for orthogonal codes with a variable spread

20   factor (OVSF), a structure according to Fig. 2, which

designates the nodes of the tree with a digital signal

sequence, is selected. Starting from a node, for example

11, a "1" is added for the upper branch in the direction

away from the root, and a "0" is added for the lower

25   branch. This simplifies evaluation of the tree structure

because the number of positions in the sequence of symbols

corresponds directly to the level of the node (and of the spread factor SF) in the tree structure.

To make a comparison of nodes, which may be necessary in the processes explained below, the position of

5   departure should be the root 18 of the tree structure. However, an inverse evaluation may also be performed, i.e., one that starts at the branches the tree.

If, for example, nodes 1110 and 1101 are compared with each other, a difference occurs at the third position

10   from the left (i.e., 11$\underline{1}$0 and 11$\underline{0}$1). Later differences are not of interest. For 10 and 1101, it is the second position. In an extreme case, the difference occurs at the eighth position (compare 1111111$\underline{0}$ and 1111111$\underline{1}$). The comparison is thus left-aligned.

15   If, for example, two nodes 00 and 001 are compared with one another, no difference can be determined. The two nodes do not differ by at least in one symbol. If no difference is found, it is an indication that two CDMA codes are directly connected to one another in the upward

20   or downward direction of the tree structure.

For the allocation of a CDMA code, all of the nodes that have no difference (i.e., the hamming distance is equal to 0) in comparison with an assigned node should be excluded. In other words, a node (1111 in Fig. 3) blocks

25   all of the nodes (111, 11, 11, 1) arranged in ascending

order in the tree, and vice versa. That is, these CDMA codes should not be used to define channels.

For channel allocation, all of the nodes are different from previously-assigned nodes are selected.

5 Furthermore, those nodes that correspond to the desired data rate are considered. As shown in Fig. 3, three nodes (101, 010, 001) are available for a desired data rate of 1024 Kbit/s with SF = 8. A selection may be made between these nodes since they are for the desired data rate.

10 For this purpose, in each case, the sum of the positions at which, in comparison with all the already assigned nodes (at least all of the assigned nodes of part of the tree structure), the first difference from the left has occurred is used for these three nodes 101, 010, 001.

15 For node 101, the sum is $9 = 2 + 2 + 3 + 1 + 1$, for node 010 the sum is $8 = 1 + 1 + 1 + 2 + 3$, and for node 001 the sum is $8 = 1 + 1 + 1 + 2 + 3$.

The sums are then compared with a predefined sum, which may be set beforehand. If the predefined sum is the

20 maximum of the sums, the node 101 is selected. If the predefined sum is the minimum of the sums, the node 010 or 001 can be selected. The selection between the remaining two nodes 010 or 001 is made randomly.

The maximum is selected if it is desired to group the

25 occupied nodes, i.e. the allocated CDMA codes, closely to one another (as shown, e.g., Fig. 4). This has advantages

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if great changes are not to be expected in the data rates

of the links. The minimum is selected in order to achieve

the most uniform possible distribution of all the CDMA

codes used in the tree. This has, in statistical terms,

5   the advantage that it provides a maximum degree of

flexibility for a later assignment of higher data rates.

According to Fig. 3, the benefit of this is not yet felt

because it is not possible to simply double the data rate

for any of the nodes 101, 010 or 001. However, the links

10   are not permanent, so that when a previously occupied CDMA

code is released, the probability of an increase in the

data rate being possible in the future is greater for

nodes 010 and 001 than for the node 110.

Fig. 4 shows links to subscribers with a basic data

15   rate of 32 Kbit/s, e.g., simple voice links. Increases in

the data rate are not expected for these subscribers. So,

the strategy of using the maximum for the predefined sum

is selected. The sum for the free node 11111101 is

$34 = 7 + 7 + 8 + 6 + 6$ and for the nodes 11111001 and

20   11111000 is the sum $32 = 6 + 6 + 6 + 7 + 7$. Accordingly,

node 11111101 is selected. A later new allocation of the

node 1111100 with a higher data rate of 64 Kbit/s is

therefore not prevented.

An additional aspect for both strategies arises if

25   not only the desired data rate is used for the link but

also a defined increased possibility for the data rate is

known. The desired data rate and/or increased possibility

for a data rate of the link is derived from an identifier

(for example a service class of the possible services or

an identification of the mobile station) or from a

5   signaled request of a mobile station for a service. These

values can also be updated in the course of a link.

The optimization of the allocation is directed at a

window of data rates for a link. In Fig. 5, in turn, some

of the nodes are already assigned. The intention is to

10 show the allocation of a CDMA code for a link with a data

rate of 32 Kbit/s with a possibility of increase to a

maximum of 64 Kbit/s. A node with a difference from an

already assigned node is selected precisely at a specific

position that corresponds to the increase possibility.

15 The possibility of increase to 64 Kbit/s corresponds to

the seventh position.

This is the case for the nodes 11111001 or 11111000

and 11110011 or 11110010, respectively. The difference

between these nodes and the nodes 11111010 and 11110000

20 occurs precisely at the seventh position (underlined).

Other free nodes already have differences at the sixth

position (11110100) or not until the eighth position

(11111111). Which of the two node pairs (11111001 or

11111000 and 11110011 or 111110010, respectively) will be

25 shortlisted depends again on the optimization to the

maximum or minimum. The selection between 11111001 or

15

11111000 and 11110011 or 11110010, respectively, is random

here. It is again noted that the possibility of

increasing the data rate should also be taken into account

for already existing links. If a possibility of increase

5   to 128 Kbit/s has been noted in advance for the link of

the node 11110000, this is an exclusion criterion for the

nodes 11110011 and 11110010.

If, for example, a link is to be operated with a data

rate of 96 Kbit/s, two CDMA codes are to be assigned.

10   More specifically, either three 32 Kbit/s codes are

assigned or one for 32 Kbit/s and a further for 64 Kbit/s.

The allocation method is thus a multi-stage method. The

desired data rate results from the totality of the

individual data rates of the CDMA codes.

15   In Fig. 5. the foregoing means, for example, that

depending on the optimization criterion one of the nodes

1111011, 1111010 or 1111001 is assigned for the 64 Kbit/s,

and subsequently a remaining free node is selected for

32 Kbit/s. The allocation of a CDMA code for the higher

20   data rate should take place before the allocation of a

CDMA code for the lower data rate.

The mobile radio system illustrated in Fig. 6 is an

example of a radio communications system is comprised of

mobile switching centers (MSC) 20 which are interlinked to

25   one another and/or constitute the access to a fixed

network PSTN 22. Furthermore, these mobile switching

centers MSC 20 are connected to in each case at least one device radio network controller (RCN) 24 for radio resource management. Each of these devices in turn is linked to at least one base station (BS) 12.

5   A base station can set up, via a radio interface, a link to further radio stations, for example mobile stations or other mobile and fixed terminals. Fig. 6 also shows links V1, V2, Vk for transmitting useful information and signaling information between mobile stations MS and a

10   base station BS. An operations and maintenance center (OMC) 26 performs monitoring and maintenance functions for the mobile radio system and for parts thereof.

         Base station 12 contains a storage device (SP) 28 (e.g., a memory) for storing the tree structure, the

15   occupied nodes and the CDMA codes, as well as a program for carrying out the allocation method and a processing device (BE) 30 (e.g., a microprocessor) for selecting a non-occupied node with corresponding CDMA code and for assigning a channel with the CDMA code to a link in

20   accordance with one of the previous strategies.

         The tree-structure coding processes described herein are not limited to use on the hardware (i.e., base station and mobile station) of Fig. 6; they may find applicability in any computing or processing environment and with any

25   type of machine that is capable of running machine-readable instructions, such as a computer program. The

processes may be implemented in hardware, software, or a combination of the two.

The processes may be implemented in computer programs executing on programmable computers that each include a

5 processor, a storage medium readable by the processor (including volatile and non-volatile memory and/or storage elements), at least one input device, and one or more output devices. Program code may be applied to data entered using an input device (e.g., a mouse or keyboard)

10 to perform the coding processes and to generate output information.

Each such program may be implemented in a high level procedural or object-oriented programming language to communicate with a computer system. However, the programs

15 can be implemented in assembly or machine language. The language may be a compiled or an interpreted language.

Each computer program may be stored on a storage medium or device (e.g., CD-ROM, hard disk, or magnetic diskette) that is readable by a general or special purpose

20 programmable computer for configuring and operating the computer when the storage medium or device is read by the computer to perform the coding processes. The coding processes may also be implemented as a computer-readable storage medium, configured with a computer program, where,

25 upon execution, instructions in the computer program cause the computer to operate in accordance with the process.

Other embodiments not described herein are also included in the scope of the following claims.

What is claimed is:

1.   A method of allocating channels in a communications system in which code division multiple access (CDMA) codes are used to define channels between a transmitter and a receiver, the method comprising:

5   deriving a new CDMA code for a channel from other CDMA codes for other channels, the new CDMA code being derived based a tree structure that contains symbols that define the new CDMA code.

10

20

Abstract

Channels are allocated in a communications system. In the system, code division multiple access (CDMA) codes are used to define the channels between a transmitter and a receiver. A new CDMA code for a channel is derived from other CDMA codes for other channels. The new CDMA code is derived based a tree structure that contains symbols that define the new CDMA code.

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Fig. 1

			1,1,1,1	1,1,1,1,1,1,1,1
		1,1,1,1		1,1,1,1,-1,-1,-1,-1
	1,1			1,1,-1,-1,1,1,-1,-1
		1,1,-1,-1		1,1,-1,-1,-1,-1,1,1
18				
		1,-1,1,-1		1,-1,1,-1,1,-1,1,-1
	1,-1			1,-1,1,-1,-1,1,-1,1
		1,-1,-1,1		1,-1,-1,1,1,-1,-1,1
				1,-1,-1,1,-1,1,1,-1

OVSF

Fig. 2

SF=2   SF=4   SF=8   SF=16

Fig. 3

SF=2   SF=4   SF=8   SF=16

 = occupied

 = free

Fig. 4

SF=32   SF=64   SF=128   SF=256

⊘ = occupied

◯ = free

Fig. 5

```
                                                          11111111 ○
                                        1111111
                                                          11111110 ⊘
                            111111
                                        1111110 ▨        11111101
                                                          11111100
                11111
                                                          11111011 ⊘
                                        1111101
                                                          11111010 ⊘
                            111110
                                        1111100           11111001 ○
                                                          11111000 ○

        1111
                                                          11110111 ○
                                        1111011
                                                          11110110 ○
                            111101
                                        1111010           11110101 ○
                                                          11110100 ○
                11110
                                                          11110011 ○
                                        1111001
                                                          11110010 ○
                            111100
                                        1111000           11110001 ○
                                                          11110000 ⊘
```

SF=32   SF=64   SF=128   SF=256

⊘ ▨ = occupied

○ ◯ = free

Fig. 6

10

14

MS

V1

16

MS

V2

MS

Vk

12   30

BS   BE

SP   28

OMC   RNC   24

26

MSC   20

PSTN

22
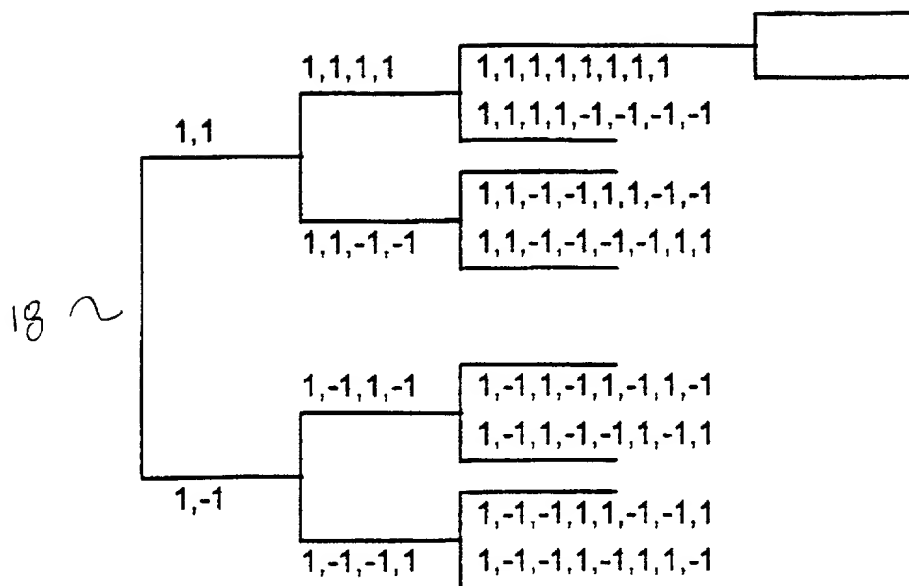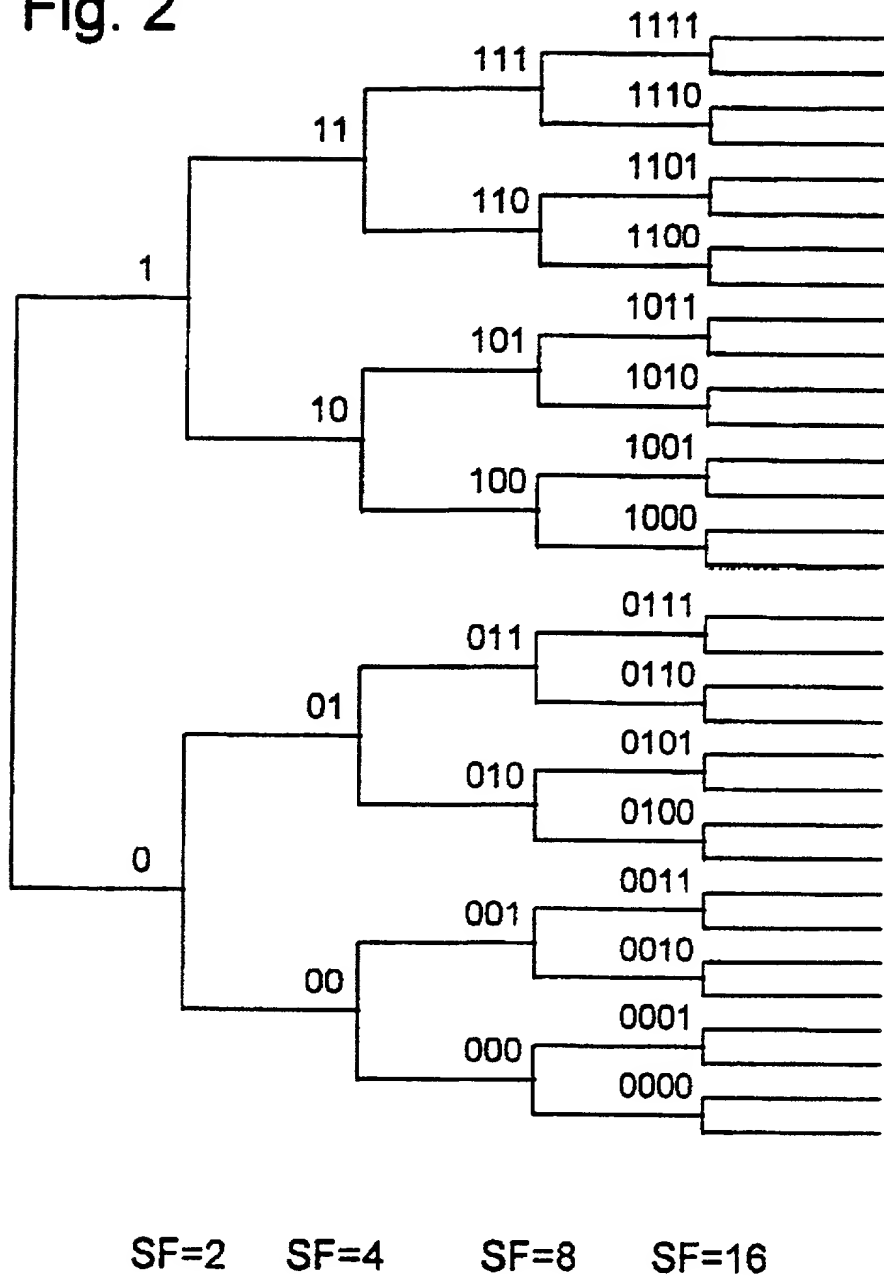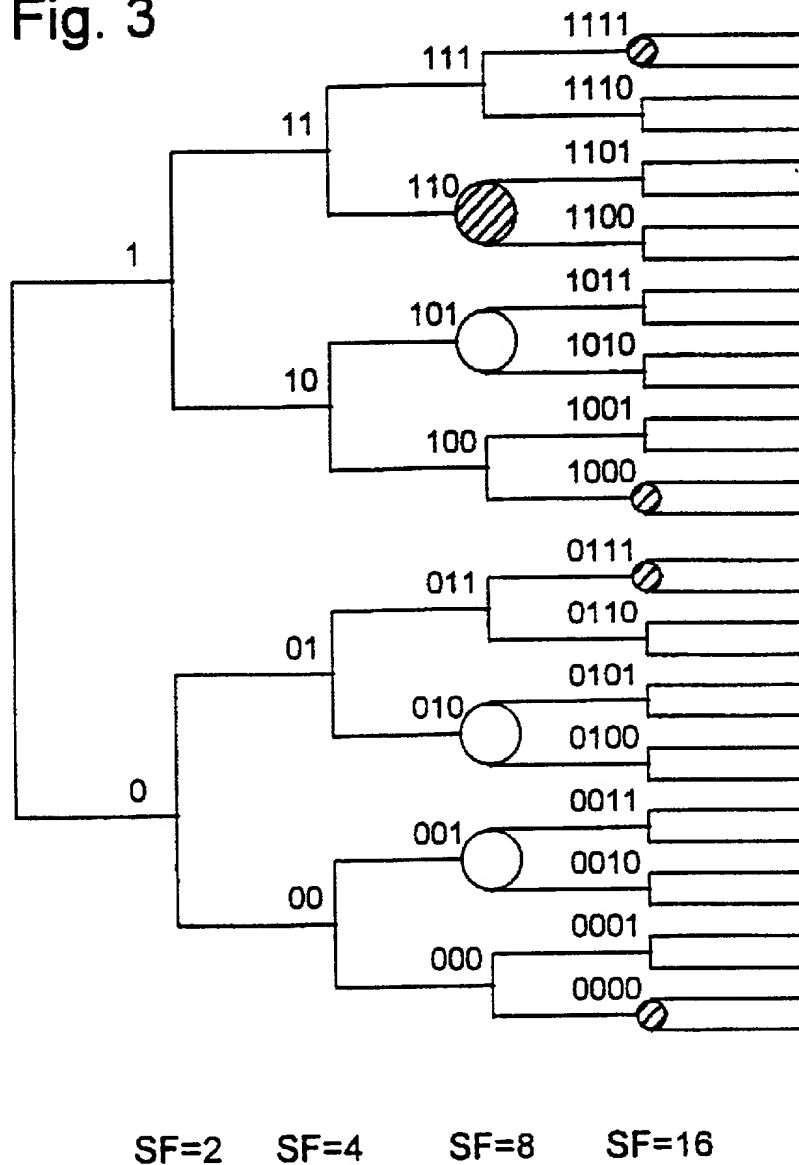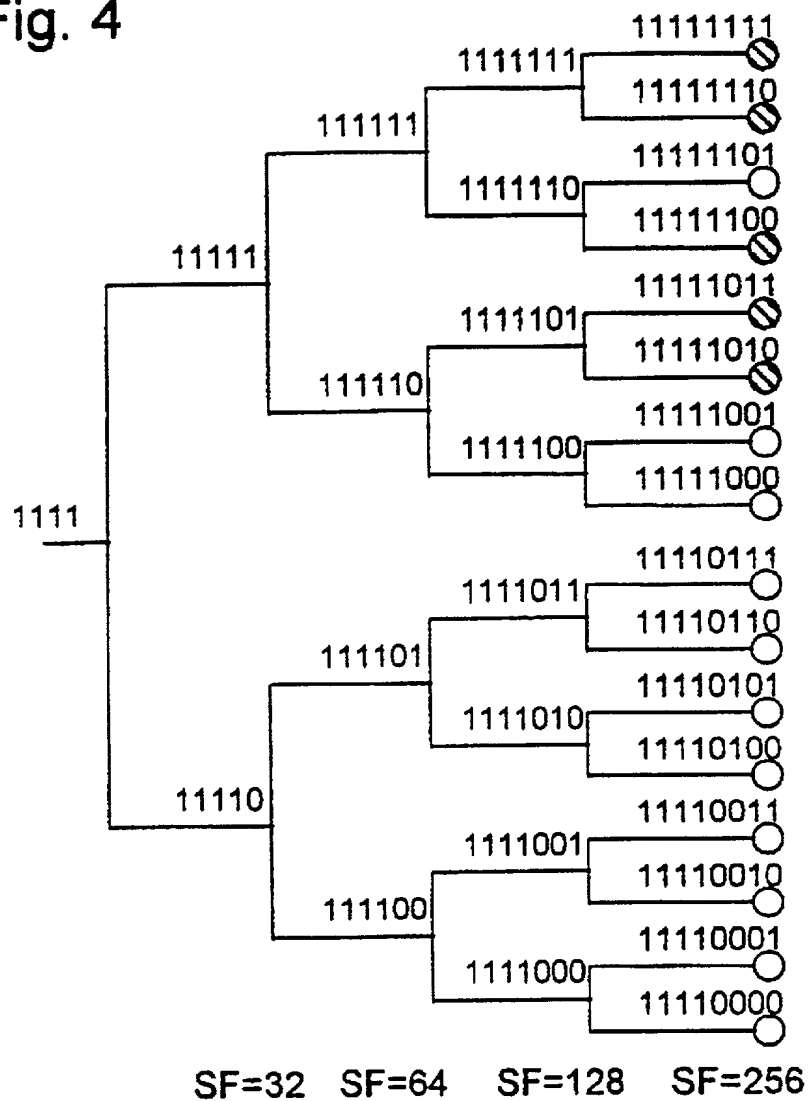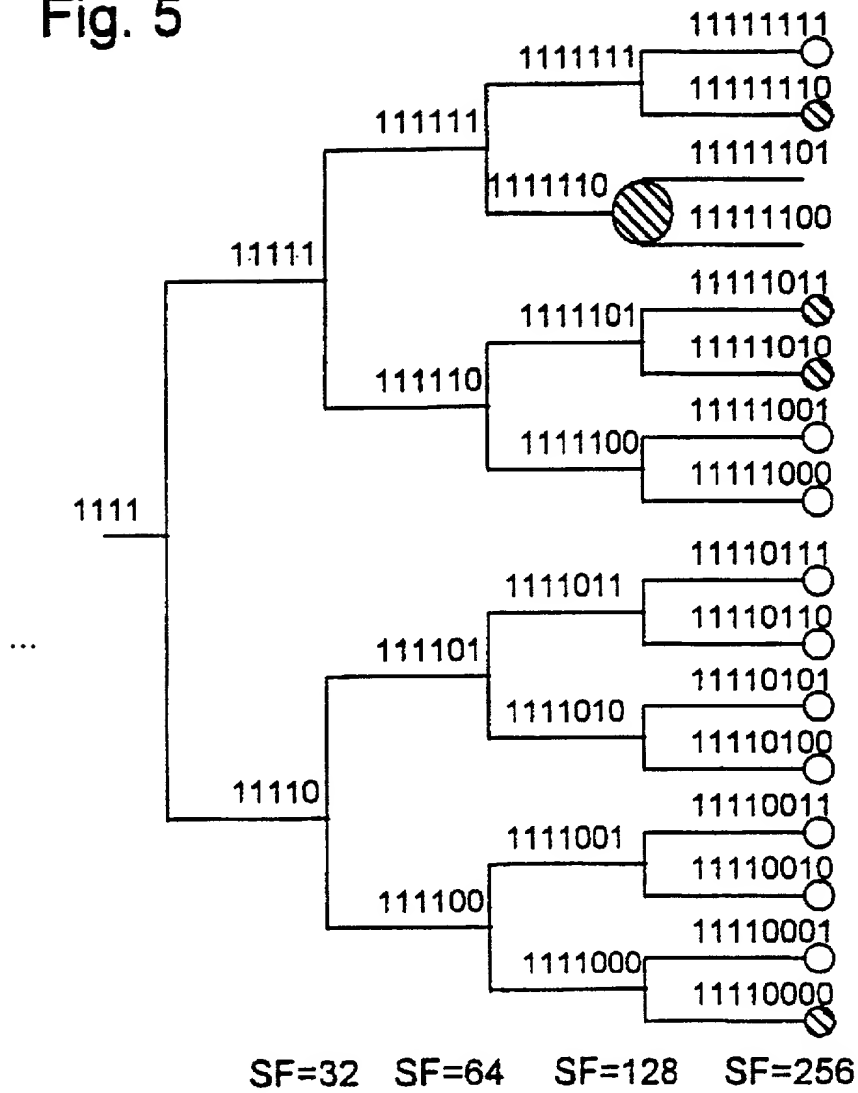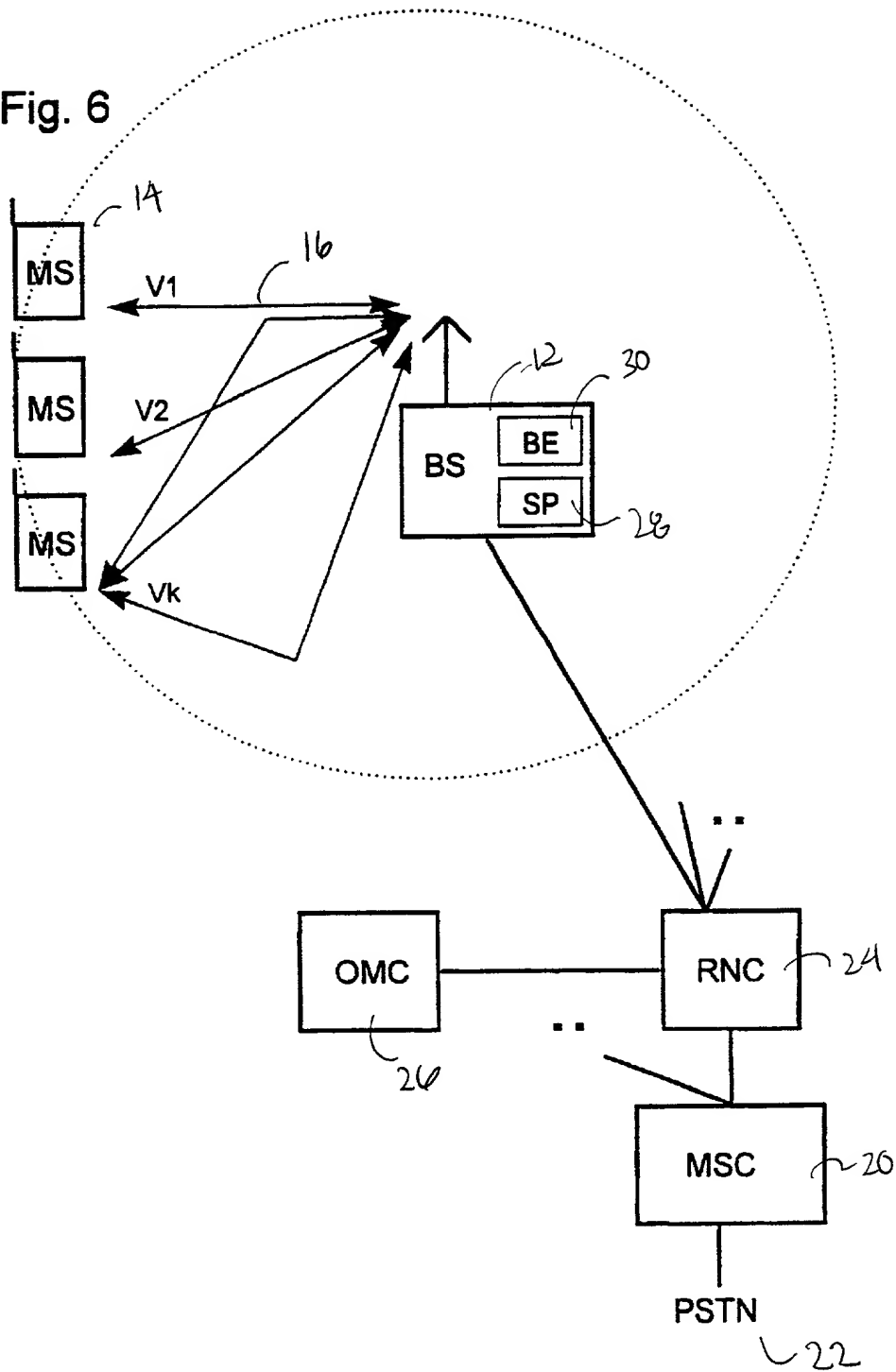
Description

Method and device for allocating channels in a
communications system with CDMA subscriber separation

5

  The invention relates to a method and a device
for allocating channels in a communications system with
CDMA subscriber separation.

  In a communications system, a channel describes
10 a link from a message source (transmitter) to a message
sink (receiver). The information which is to be
transmitted is usually encoded, modulated and amplified
at the transmit end so that after transmission, which
generally entails attenuation and distortion, said
15 information can be evaluated at the receive end by
means of measures corresponding to the transmit end.

  The transmission medium used can be a line or a
radio interface. In the latter case, radio
communications systems are referred to, and these have
20 become widespread in the form of mobile radio systems.

  In radio communications systems, information
(for example voice, image information or other data) is
transmitted using electromagnetic waves via a radio
interface between the transmitting and receiving radio
25 stations (base station and mobile station,
respectively). The electromagnetic waves are emitted
here with carrier frequencies which lie in the
frequency band which is provided for the respective
system. Frequencies in the approximately 2000 MHz
30 frequency band are provided for future mobile radio
systems with CDMA or TD/CDMA transmission methods via
the radio interface, for example the UMTS (Universal
Mobile Telecommunication System) or other 3rd
Generation systems.

35

FDMA (frequency division multiple access), TDMA (time division multiple access) or CDMA (code division multiple access) subscriber separation methods are used to discriminate between the signal sources, and thus to

5 evaluate the signals. These separation methods can also be combined. In the CDMA subscriber separation method the channels are distinguished by means of the individual CDMA codes.

Channel allocation methods describe a strategy

10 of allocating the channels to the individual links so as to make best possible use of the radio resources of the radio interface, in which process care is taken to ensure that the expenditure on adaptation during the allocation of the channels to the previous links which

15 is due to future changes in the data rate of individual links should be as small as possible. The expenditure on adaptation arises if a CDMA code has to be removed from an existing link and a different CDMA code has to be allocated to said link. This object is achieved for

20 a communications system with CDMA subscriber separation by means of the present invention having the features of claims 1 and/or 14. Advantageous developments of the invention can be found in the subclaims.

In the method for allocating channels according

25 to the invention, the CDMA codes form the channels for links, the CDMA codes which are available for the allocation of channels being derived from one another in accordance with a tree structure. A chip sequence of a higher order CDMA code is thus, for example, a subset

30 of the chip sequence of a lower order CDMA code. The CDMA codes are represented by nodes within the tree structure. In one node, a plurality of branches respectively converge and in turn lead to further lower order nodes.

35 The nodes are represented for the channel allocation method by means of a sequence of symbols, the sequences of symbols of two nodes differing at one position which corresponds to the distance between the two nodes and their joining node within

40

the tree structure. A small position means that two
nodes differ greatly, and thus a difference already
occurs near to the root of the tree structure. In other
words, the joining node (father node) is near to the
5   root in this case. Free nodes and assigned nodes are
distinguished, a free node designating a non-assigned
CDMA code and an occupied node designating an assigned
CDMA code. Only non-assigned CDMA codes can be
allocated.

10   For the allocation of a free CDMA code to a
link, all the free nodes which are not connected to an
already occupied node directly in the upward or
downward direction in the tree structure, i.e. differ
from an already occupied node in at least one symbol,
15   are selected in a first step. It is not permissible to
allocate any CDMA code whose chip sequence is a precise
subset of a CDMA code which has already been assigned
or of which the chip sequence of a CDMA code which has
already been assigned forms a subset.

20   In a further step, the position in the sequence
of symbols at which a difference from an already
occupied node occurs is determined for the selected
nodes, starting in each case with the root of the tree
structure. The position is consequently a measure of
25   the discriminating power of two CDMA codes. If two CDMA
codes differ greatly, the data rate can be increased
for one of the CDMA codes without a collision with the
second CDMA code occurring. Furthermore, a sum of the
positions is determined for all the occupied nodes, and
30   the channel with the CDMA code which corresponds to the
node of the predefinable sum is allocated. The
allocation strategy is thus related to the
discriminating power with respect to all the other CDMA
codes, i.e. to the sum of the instances of
35   discrimination.
        The tree structure is advantageously
constructed in such a way that the distance between a
node and the root corresponds to an increase

in the spread factor of the CDMA code, and thus
directly to a reduction in the data rate for the link.
The data rate can be increased without adapting the
allocation of the other CDMA codes only by changing a
5 CDMA code in that the existing node is removed and a
new node is allocated within the tree structure
starting from the existing node in the direction of the
root.

An advantageous development of the allocation
10 strategy provides for the predefinable sum to be the
smallest of the sums. This ensures that the CDMA codes
differ greatly, thus providing the possibility of the
data rate for the link with the newly allocated CDMA
code being increased to a maximum degree in future
15 without adapting the rest of the allocation process.

The objective is different if no increase, or
only a limited increase, in the data rate is possible
or desired for a large number of connections, for
example for subscribers with a fixed basic data rate.
20 Here, it is advantageous that the predefinable sum is
the greatest of the sums. CDMA codes which do not
differ greatly are thus assigned, that is to say parts
of the tree structure are kept free for further links
with possibly higher data rates.

25 A mixed form of the previous two strategies
provides for an increase possibility to be defined for
a data rate of the link, and for a node with a
difference from an already occupied node at a specific
position to be selected, the position corresponding to
30 the increase possibility. The possibility of increasing
the data rate is expressed in the tree structure in the
number of nodes which can be displaced in the direction
of the root (a node before the joining node with an
already occupied node) without a collision occurring
35 with a CDMA code which has already been assigned. If
the increase possibility is known in advance,

a part of the tree structure which is just sufficient, i.e. not too much and not too little, can therefore be reserved.

In addition, an increase possibility for the links for the already occupied nodes is advantageously taken into account in the selection of the node. The increase possibilities for the existing links are therefore not affected.

The method can also be implemented in a multi-stage way. Thus, one advantageous development of the invention provides for a plurality of channels with different CDMA codes to be allocated, a desired data rate resulting from the totality of the individual data rates of the CDMA codes. The free nodes of the tree structure can nevertheless be well utilized with a high utilization rate, i.e. occupancy of the nodes.

For digital systems which are widespread the symbols are digital values. From each node a branch branches off in the direction of the root and two branches branch off in the opposite direction. A mapping of the CDMA codes onto the tree structure which can be implemented particularly easily provides for the two following nodes of the outgoing branches to be mapped, starting from the root of the tree structure, by means of an additional "0" or "1" in the sequence of symbols, the number of bits corresponding to the sequence of symbols with the spread factor. Irrespective of the overall construction of the CDMA codes, the digital tree structure is organized in a very clear way. The CDMA codes are, for example, orthogonal codes (OVSF) with a variable spread factor. As a result, detection on the receive side is made easier because such CDMA codes continuously support optimum decorrelation.

Although a channel assignment system according to the invention can be used in a very wide variety of communications systems, use in the downward direction of a radio interface in a broadband radio communications

system is particularly advantageous. Such a radio interface is designed for a 3rd mobile radio generation and it can support a larger number of channels. The greater the number of channels, the more important it is to have a good assignment strategy.

According to further advantageous embodiments of the invention, a desired data rate and/or increase possibility for a data rate of the link is derived from an identifier and/or from a signaled request of a mobile station. The increase possibility can thus be determined precisely for the mobile stations, in accordance with the current link profiles and service profiles, so that only free spaces in the tree structure which are necessary and useful are reserved in the assignment strategy.

The invention is explained below in more detail by means of an exemplary embodiment and with reference to drawings, in which

Fig. 1 shows the structure of orthogonal CDMA codes with a variable spread factor,

Fig. 2 shows a tree structure representing the CDMA codes,

Figs 3 - 5 show allocation strategies for the allocation of channels, and

Fig. 6 shows a schematic representation of a mobile radio system.

In communications systems with CDMA subscriber separation, the different links can be distinguished by means of an individual CDMA code with which the signals of the links are spread. An example for such a communications system is a digital radio communications system with broadband channels which is known from "UTRA Physical Layer Description FDD parts", v0.4, dated June 25, 1998.

For the downlink direction, i.e. for a radio transmission from base stations to mobile stations, orthogonal codes with a variable spread factor OVSF and with a fixed chip rate of 4.096 Mcps according to fig. 1 are used. The orthogonal codes with a variable spread factor OVSF can be represented in a tree structure, the individual CDMA codes being derived from one another within the tree structure.

From one level of the tree to another the number of chips per CDMA code, and thus the spread factor SF, doubles. Starting from the CDMA code with the chip sequence (1, 1) two CDMA codes of the next lowest level (1, 1, 1, 1) and (1, 1, -1, -1) are derived. The first half (1, 1) is accepted and the second half either accepted (1, 1) or accepted in inverted form (-1, -1). This produces a code family over, for example, eight levels. Within the eight levels there are 508 different CDMA codes with eight different data rates (2048 Kbit/s with a spread factor $SF = 4$, 1024 Kbit/s with $SF = 8$, 512 Kbit/s with $SF = 16$, 256 Kbit/s with $SF = 32$, 128 Kbit/s with $SF = 64$, 64 Kbit/s with $SF = 128$, 32 Kbit/s with $SF = 256$). For example, a 32 Kbit/s gross data rate is needed to encode voice information with an 8 Kbit/s net data rate and transmit it via the radio interface with error protection.

Within the level with a spread factor $SF = 256$ there are 256 different CDMA codes, and at the next highest level there are 128 CDMA codes etc. The CDMA codes are allocated in accordance with the data rate required by the link. If all the CDMA codes are still free, i.e. in the run-up phase, one of the CDMA codes can be allocated at random. However, if some of the CDMA codes have already been assigned, peripheral conditions have to be taken into account in the allocation of a CDMA code which is still free to a new link.

The CDMA codes which are used within a frequency band in a radio cell must

differ at least in part of their chip sequence. Furthermore, changes in the data rate of a link must be allowed for in a predictive fashion, and CDMA codes of a higher level must not be blocked by the new allocation of a lower level CDMA code.

Thus, for the orthogonal codes with a variable spread factor OVSF, a representational form of a tree structure according to fig. 2 which designates the nodes of the tree with a digital signal sequence is selected. Starting from a node, for example 11, a "1" is added for the upper branch which goes away from the root, and a "0" is added for the lower branch. This simplifies evaluation of the tree structure because the number of positions of the sequence of symbols thus corresponds directly to the level of the node (and of the spread factor SF) in the tree.

To make a comparison of nodes, which is necessary for the algorithms explained below, the position of departure should be the root of the tree. However, for the person skilled in the art it is self-evident that a respectively inverted evaluation is also possible.

If, for example, the nodes

1110 and

1101 are compared with one another, a difference occurs at the third position from the left. Later differences are not of interest.

For 10 and

1101 it is the second position. In the extreme case, the difference occurs at the eighth position (compare 11111110 and 11111111). The comparison is thus left-aligned.

If, for example, the nodes

00 and

001 are compared with one another, no difference can be determined. The two nodes do not differ at least

in one symbol. If no difference can be determined, this corresponds to two CDMA codes, which are directly connected to one another in the upward or downward direction in the tree structure.

5   For the allocation of a CDMA code, all the nodes which have no difference (Hamming distance is equal to 0) in comparison with one of the occupied nodes should be excluded. In other words, a node (1111 in fig. 3) blocks all the nodes (111, 11, 11, 1)

10   arranged in ascending order in the tree, and vice versa.

For the allocation, all the nodes which have a difference from all the occupied nodes are thus selected. Furthermore, only those nodes which

15   correspond to the desired data rate are considered. According to Fig. 3, three nodes (101, 010, 001) are available for a desired data rate of 1024 Kbit/s with SF = 8. A selection must be made between these nodes.

For this purpose, in each case the sum of the

20   positions at which, in comparison with all the already occupied nodes (at least all the occupied nodes of part of the tree structure), the first difference from the left has occurred is used for these three nodes 101, 010, 001. For the node 101 the sum is 9 = 2 + 2 + 3 + 1 + 1,

25   for the node 010 the sum is 8 = 1 + 1 + 1 + 2 + 3 and for the node 001 the sum is 8 = 1 + 1 + 1 + 2 + 3.

The sums are then compared with a predefinable sum. If the predefinable sum is the maximum, the node 101 is selected. If the predefinable sum is the

30   minimum, the node 010 or 001 can be selected. The selection between the two nodes 010 or 001 is random.

The maximum is selected if it is desired to group the occupied nodes, i.e. the allocated CDMA codes, closely to one another (see fig. 4). This has

35   advantages if great changes are not to be expected in the data rates of the links.

The minimum is selected in order to achieve the most uniform possible distribution of all the CDMA codes used in the tree. This has in statistical terms the advantage that it provides a maximum degree of flexibility for a later assignment of higher data rates. According to fig. 3, the benefit of this is not yet felt because it is not possible to simply double the data rate for any of the nodes 101, 010 or 001. However, the links are not permanent so that when a previously occupied CDMA code is released the probability of an increase in the data rate being possible in the future is greater for the nodes 010 and 001 than for the node 110.

Fig. 4 shows links to subscribers with a basic data rate of 32 Kbit/s, for example simple voice links. Increases in the data rate are not expected for these subscribers so that the strategy with the maximum for the predefinable sum is selected. The sum for the free node 11111101 is $34 = 7 + 7 + 8 + 6 + 6$, for the nodes 11111001 and 11111000 is the sum $32 = 6 + 6 + 6 + 7 + 7$ in each case. The node 11111101 is consequently selected. A later new allocation of the node 1111100 with a higher data rate of 64 Kbit/s is therefore not prevented.

An additional aspect for both strategies arises if not only the desired data rate is used for the link but also a defined increase possibility for the data rate is also known. The desired data rate and/or increase possibility for a data rate of the link is derived from an identifier (for example a service class of the possible services or an identification of the mobile station) or from a signaled request of a mobile station for a service. These values can also be updated in the course of a link.

The optimization of the allocation is directed at a window of data rates for a link. In Fig. 5, in turn

some of the nodes are already occupied. The intention
is to show the allocation of a CDMA code for a link
with a data rate of 32 Kbit/s with a possibility of
increase to a maximum of 64 Kbit/s. A node with a
5   difference from an already occupied node is selected
precisely at a specific position which corresponds to
the increase possibility. The possibility of increase
to 64 Kbit/s corresponds to the seventh position.

This is the case for the nodes 11111001 or
10   11111000 and 11110011 or 11110010, respectively. The
difference between these nodes and the nodes 11111010
and 11110000 occurs precisely at the seventh position.
Other free nodes already have differences at the sixth
position (11110100) or not until the eighth position
15   (11111111). Which of the two node pairs (11111001 or
11111000 and 11110011 or 111110010, respectively) will
be shortlisted depends again on the optimization to the
maximum or minimum. The selection between 11111001 or
11111000 and 11110011 or 11110010, respectively, is
20   random here. As a peripheral condition it is to be
noted again that the possibility of increasing the data
rate should also be taken into account for already
existing links. If a possibility of increase to
128 Kbit/s has been noted in advance for the link of
25   the node 11110000, this is an exclusion criterion for
the nodes 11110011 and 11110010.

If, for example, a link is to be operated with
a data rate of 96 Kbit/s, two CDMA codes are to be
assigned, to be precise either three 32 Kbit/s codes or
30   one for 32 Kbit/s and a further for 64 Kbit/s. The
allocation method is thus a multi-stage method. The
desired data rate results from the totality of the
individual data rates of the CDMA codes. For fig. 5
this means, for example, that depending on the
35   optimization criterion one of the nodes 1111011,
1111010 or 1111001 is assigned for the 64 Kbit/s, and
subsequently a remaining free node is selected for
32 Kbit/s. The allocation of a

CDMA code for the higher data rate should take place before the allocation of a CDMA code for the lower data rate.

The mobile radio system illustrated in fig. 6 as an example of a radio communications system is composed of mobile switching centers MSC which are interlinked to one another and/or constitute the access to a fixed network PSTN. Furthermore, these mobile switching centers MSC are connected to in each case at least one device RNC (radio network controller) for radio resource management. Each of these devices RNC in turn makes possible a link to at least one base station BS. Such a base station BS can set up, via a radio interface, a link to further radio stations, for example mobile stations MS or other mobile and fixed terminals. Fig. 6 represents by way of example links V1, V2, Vk for transmitting useful information and signaling information between mobile stations MS and a base station BS. An operations and maintenance center OMC carries out monitoring and maintenance functions for the mobile radio system and for parts of it.

The base station BS contains a storage device SP for storing the tree structure, the occupied nodes and the CDMA codes, as well as a program for carrying out the allocation method and a processing device BE for selecting a non-occupied node with corresponding CDMA code, and for assigning a channel with the CDMA code to a link in accordance with one of the previous strategies.

Patent claims

1. A method for allocating channels in a communications system with CDMA subscriber separation, CDMA codes forming the channels for links, in which
   - the CDMA codes which are available for allocating channels are derived from one another in accordance with a tree structure,
   - nodes which respectively join a plurality of branches for the tree structure are represented by a sequence of symbols, the sequences of symbols of two nodes differing at a position which corresponds to the distance in between the two nodes and their joining node within the tree structure,
   - a free node refers to a non-assigned CDMA code and an occupied node refers to an assigned CDMA code,
   - all the free nodes which are not directly connected, upwards or downwards in the tree structure, to a node which has already been occupied, i.e. differ from an already occupied node in at least one symbol, are selected for the allocation of a CDMA code to a link,
   - the position in the sequence of symbols at which a difference from an already occupied node occurs, and a sum of the positions for the occupied nodes, is determined for the selected nodes, in each case starting with the root of the tree structure, and
   - the channel with the CDMA code which corresponds to the node with a predefinable sum is allocated.

2. The method as claimed in claim 1, in which the tree structure is constructed in such a way that the distance between a node and the root corresponds to an increase in the spread factor (SF) of the CDMA code, and thus to a reduction in the data rate for the link.

3. The method as claimed in claim 1 or 2, in which the predefinable sum is the smallest of the sums.

4.   The method as claimed in claim 2, in which the predefinable sum for a link to a data rate which does not vary very much is the greatest of the sums.

5.   The method as claimed in claim 4, in which an increase possibility for a data rate of the link is defined and a node with a difference from an already occupied node at a specific position is selected, the position corresponding to the increase possibility.

6.   The method as claimed in claim 5, in which an increase possibility for the links for the already occupied nodes is additionally taken into account in the selection of the node.

7.   The method as claimed in claim 2, in which a plurality of channels with different CDMA codes are allocated, a desired data rate resulting from the totality of the individual data rates of the CDMA codes.

8.   The method as claimed in one of the preceding claims, in which the symbols are digital values, and from each node a branch branches off in the direction of the root and two branches branch off in the opposite direction.

9.   The method as claimed in claim 8, in which, starting from the root of the tree structure, the two following nodes of the outgoing branches are mapped by means of an additional "0" or "1" in the sequence of symbols, the number of bits corresponding to the sequence of symbols with the spread factor (SF).

10.   The method as claimed in one of the preceding claims, in which the CDMA codes are orthogonal codes (OVSF) with a variable spread factor.

11.   The method as claimed in one of the preceding claims, in which

the allocation of channels for the downward direction of a radio interface is carried out in a broadband radio communications system.

12.   The method as claimed in one of the preceding claims, in which a desired data rate and/or increase possibility for a data rate of the link is derived from an identifier of a mobile station (MS).

13.   The method as claimed in one of claims 1 to 11, in which a desired data rate and/or increase possibility for a data rate of the link is derived from a signaled request of a mobile station (MS).

14.   A device for carrying out the method as claimed in claim 1 for a communications system with a CDMA subscriber separation,

having a storage device (SP) for storing the tree structure, the occupied nodes and the CDMA codes,

having a processing device (BE) for selecting a non-occupied node with corresponding CDMA code and

for allocating a channel with the CDMA code to a link.

Abstract

Method and device for allocating channels in a
communications system with CDMA subscriber separation

In the method according to the invention for
allocating channels, CDMA codes form the channels for
links. The CDMA codes are mapped by means of sequences
of symbols in a tree structure and can be derived from
one another. In accordance with different allocation
strategies, the position in the sequence of symbols at
which a difference from an already occupied node occurs
is determined for the nodes which are still available,
starting in each case with the root of the tree
structure. A sum of the positions relating to the
occupied nodes is determined and the channel with the
CDMA code which corresponds to the node with a
predefinable sum – the smallest or greatest sum – is
allocated. As a result, it is possible to administer
links both with a fixed and with a variable data rate
in W-CDMA mobile radio systems without expenditure on
adapting the allocation of the channels.

Fig. 3

Fig. 1

OVSF

Fig. 2

SF=2   SF=4   SF=8   SF=16

Fig. 3

SF=2   SF=4   SF=8   SF=16

⊘ ⊘ = occupied

◯ = free

Fig. 4

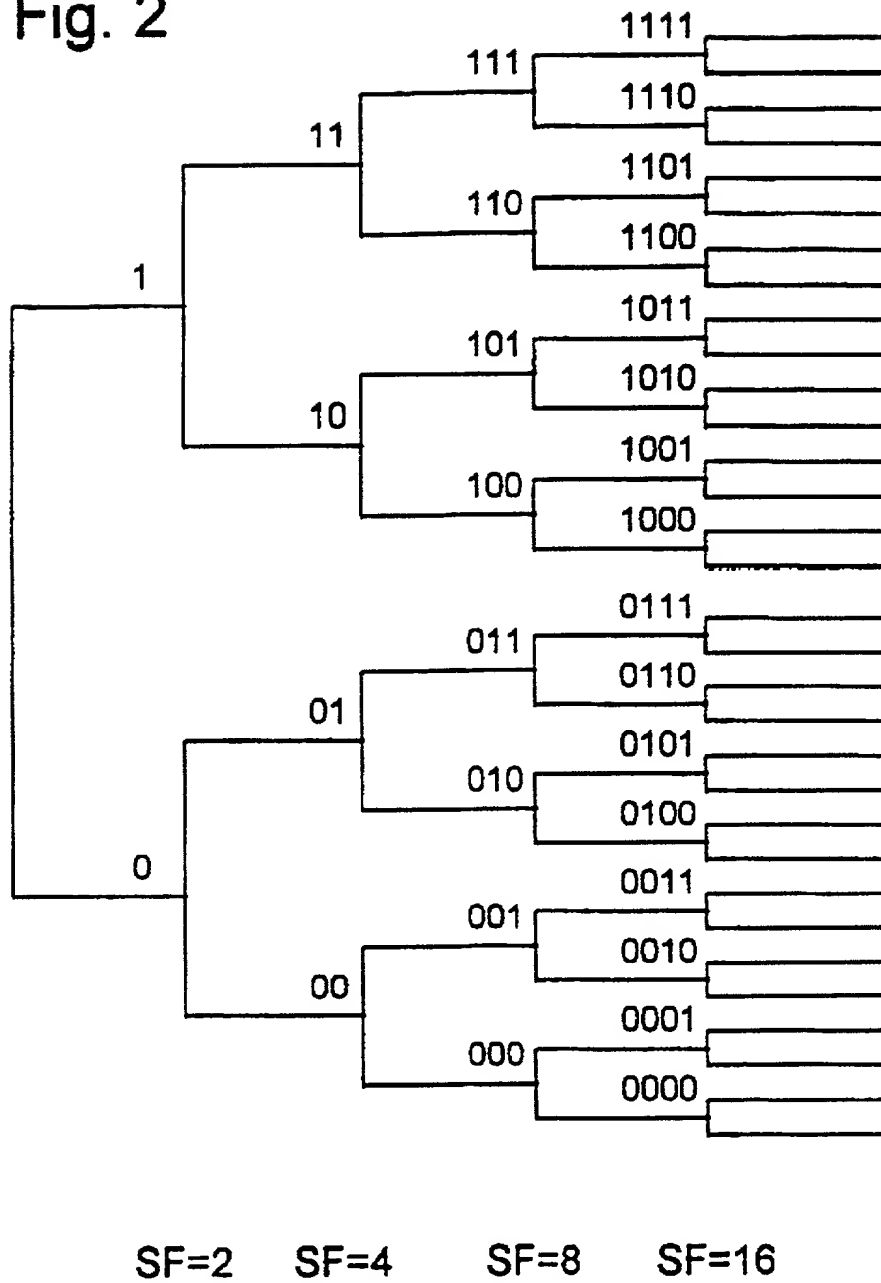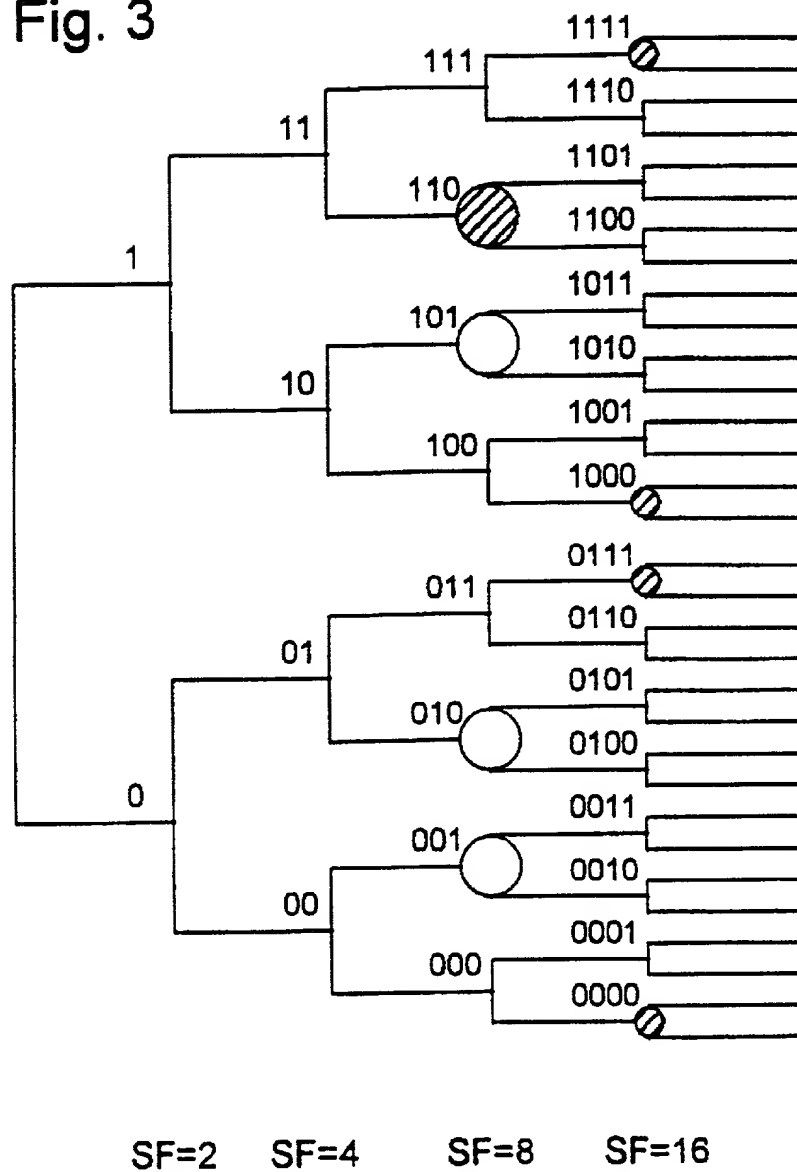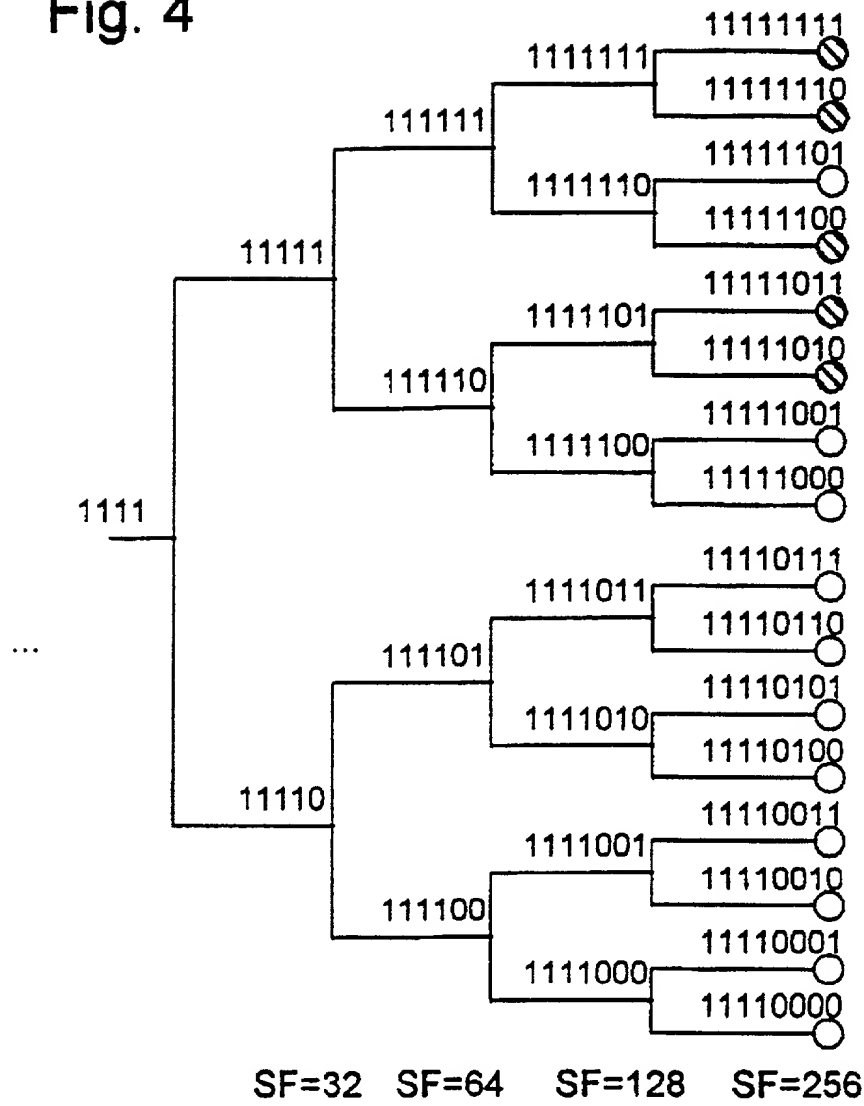SF=32   SF=64   SF=128   SF=256

⊘ = occupied

○ = free

Fig. 5


```
                                                        11111111 ○
                                      1111111   
                                                        11111110 ◍
                             111111
                                                        11111101
                                      1111110   ▨
                                                        11111100
                   11111
                                                        11111011 ◍
                                      1111101
                                                        11111010 ◍
                             111110
                                                        11111001 ○
                                      1111100
                                                        11111000 ○
        1111
                                                        11110111 ○
                                      1111011
                                                        11110110 ○
                             111101
                                                        11110101 ○
                                      1111010
                                                        11110100 ○
                   11110
                                                        11110011 ○
                                      1111001
                                                        11110010 ○
                             111100
                                                        11110001 ○
                                      1111000
                                                        11110000 ◍
```
...

SF=32   SF=64   SF=128   SF=256

⊘ ▨ = occupied

○ ◯ = free

Fig. 6

MS

MS

MS

V1

V2

Vk

BS | BE | SP

OMC — RNC

..

..

MSC

PSTN
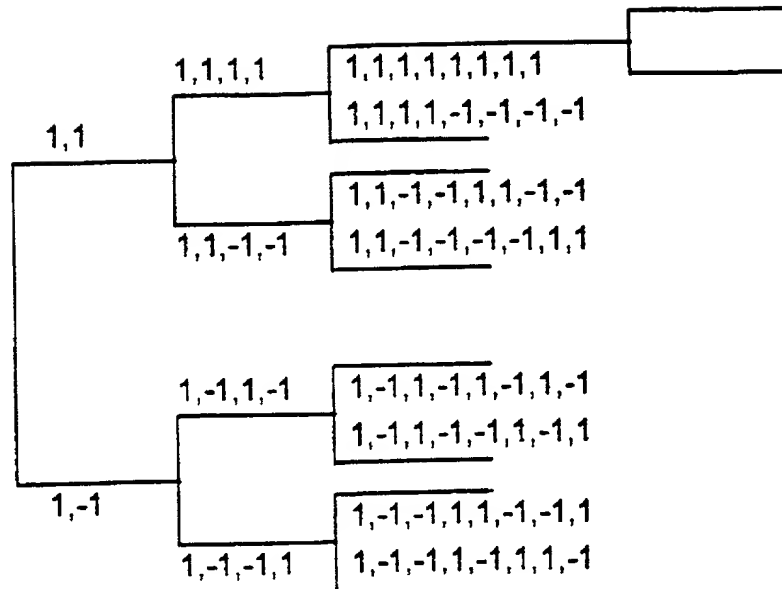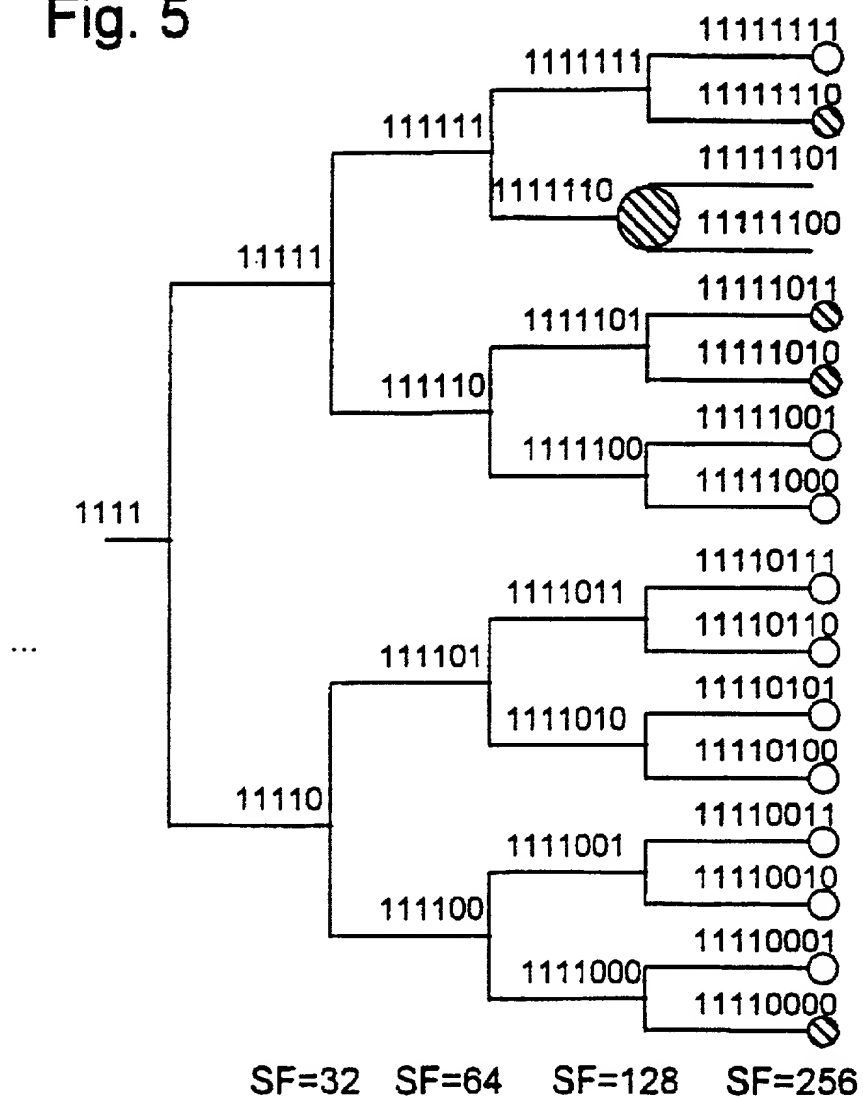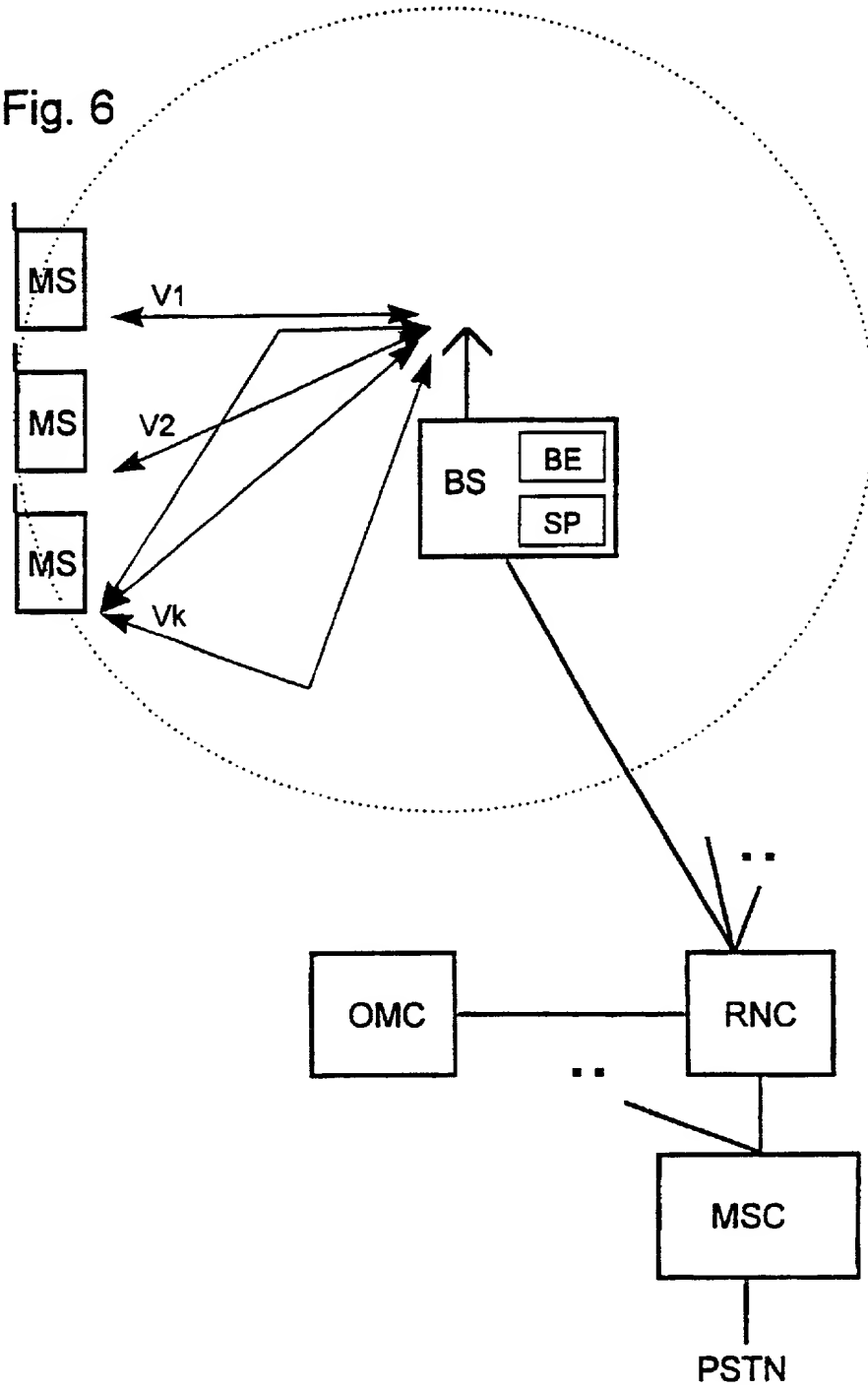
Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

#3

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:	As a below named Inventor, I hereby declare that:
dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,	My residence, post office address and citizenship are as stated below next to my name,
dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:	I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

__Verfahren und Einrichtung zur Kanalzuteilung in einem Kommunikationssystem mit CDMA-Teilnehmerseparierung__

__Method and device for allocating channels in a communication system with cdma subscriber separation__

deren Beschreibung	the specification of which
(zutreffendes ankreuzen) ☐ hier beigefügt ist. ☒ am __02.08.1999__ als PCT internationale Anmeldung PCT Anmeldungsnummer ___09/744.881___ eingereicht wurde und am ___ abgeändert wurde (falls tatsächlich abgeändert).	(check one) ☐ is attached hereto. ☒ was filed on __02.08.1999__ as PCT international application PCT Application No. ___09/744.881___ and was amended on ___ (if applicable)
Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.	I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.
Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.	I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).
Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.	I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

IDNR: 2590 / V: 99-1.00 / B:Val

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German Language Declaration

Prior foreign appplications
Priorität beansprucht

Priority Claimed

<u>19835643.9</u>	<u>DE</u>	<u>06.08.1998</u>	☒ Yes Ja ☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	

(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja ☐ No Nein

(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja ☐ No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT Internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

<u>09/744,881</u>	<u>02.08.1999</u>	(Status)	(Status)
(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D, M, Y) (Anmeldedatum T, M, J)	(patentiert, anhängig, aufgegeben)	(patented, pending, abandoned)

(Application Serial No.) (Anmeldeseriennummer)	(Filing Date D,M,Y) (Anmeldedatum T, M; J)	(Status) (patentiert, anhänglg, aufgeben)	(Status) (patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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German Language Declaration

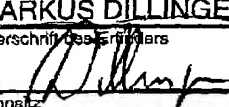|	
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Voller Name des zweiten Miterfinders (falls zutreffend):	Full name of second joint inventor, if any:
Unterschrift des Erfinders Datum	Second inventor's signature Date
Wohnsitz	Residence
Staatsangehörigkeit	Citizenship
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(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).	*(Supply similar information and signature for third and subsequent joint inventors).*

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